Glucagon Signaling Model

In this activity, you will model the glucagon signaling pathway to reinforce the concept of signal transduction pathways. Your models must be 3D with a **physical object** representing each highlighted molecule in the chart below, its **name labeled**, the **description of the step,** and whether it is part of the **initiation phase**, the **transduction phase** or the **response phase**. I will have various materials for use but feel free to bring in any materials of your choice for your own model.

Step 1:	**Glucagon** binds to **glucagon membrane receptor**
Step 2:	**Glucagon membrane receptor** activated
Step 3:	**G-Protein** activated
Step 4:	**G-Protein** binds **ATP**
Step 5:	**G-Protein** activates **Adenylyl Cyclase**
Step 6:	**Adenylyl Cyclase** converts **ATP** into **cAMP**
Step 7:	**cAMP** activates 1 **Kinase-A1** molecule
Step 8:	**Kinase A1** molecule activates 2 **Kinase-A2** molecules (use different object or different colored object of the same type for Kinase-A2 than Kinase-A1)
Step 9:	Each **Kinase A2** molecule activates 2 **Kinase-A3** molecules (use different object or different colored object of the same type for Kinase-A3 than Kinase-A1 & Kinase A-2)
Step 10:	**Kinase-A3** promotes **glycogen** stored in cell to be broken down, making free **glucose** available
Step 11:	**Kinase-A3** inhibits a **glycogen synthesis enzyme**, making free **glucose** stay available
Step 12:	**Kinase-A3** activates **RNA polymerase enhancer**, expressing the **gene** that makes an **enzyme for gluconeogenesis** (synthesis of glucose from other biomolecules), making more **glucose** available
Step 13:	**Kinase-A3** activates an **inhibitor** of a major glycolysis enzyme (**F26P**), assuring glycolysis can't break down **glucose**, keeping the glucose levels high

The model can be as small or large as you want it to be as long as all components are on it.

You can write the steps as I have them outlined above, but they and the modeled part names must be written on your model, not on a separate paper.

The only material I will NOT provide is a structure to build your model on since everyone's models may be different sizes.

Each person must do their own model but feel free to share ideas about materials.

The model should also represent the appearance of a cell with the membrane & nucleus/DNA.

You should use the same physical object for the same molecule type but it should be a different color or texture (i.e. Kinase A3 & Kinase A2 could be "m & m's" but different colors.

Many steps have molecules proceed into subsequent steps; this must be modeled as a distinct step. For example step 1 would show the glucagon receptor with attached ligand and step 2 would need a second of the same object representing the glucagon receptor being activated.

Grading Rubric

All 13 steps are described accurately on the model **13 Points**	Steps are not described as stated in the chart **-1 Point Each**
All 13 steps are modeled with distinct objects aligned throughout **17 Points**	The same object is repeated incorrectly or the same object was not repeated when it should have been **-1 Point Each**
All molecules are labeled on the model **37 Points**	Parts are not labeled **-1 Point Each**
The steps are all categorized by their correct phase **13 Points**	Steps are not categorized by the correct phase **-1 Point Each**
The model has the appearance of a cell & is thoughtfully constructed **20 Points**	The model is not an accurate representation of a cell or looks messy **-5 Points Each**